Forecasts of Profitability and the Pricing of Shares

Is the Dow Jones Industrial Average Over-priced?

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SPECIAL ISSUE

1 Introduction

The focus of most analysis of corporate performance – both *ex ante* and *ex post* – is on accounting earnings. Yet the focus of most valuation models is on future cash flows. In the absence of a valuation model linking forecasts of earnings to firm value, these earnings must be converted into cash flows by backing out the implied accounting accruals. Recent accounting research literature has addressed the idea of using the earnings forecasts without the necessity of backing out accruals. The model that uses forecasts of profitability to determine implicit value is referred to as *the residual income valuation model*. This model is becoming the center-piece in MBA courses on financial statement analysis and valuation and it is becoming increasingly popular on Wall Street. This paper describes the model and discusses its uses in analyzing and understanding the pricing of corporate shares. The features of the model are illustrated using analysts' forecasts of earnings for the firms in the Dow Jones Industrial Average at the end of 1998.

The paper begins with a discussion of the well-known dividend capitalization model that is a fundamental part of the residual income valuation model. After deriving the dividend capitalization model, I define residual income and show the derivation of the residual income valuation model. Although both of these models assume an infinite investment horizon, they may be modified to deal with the practical issue that forecasts are for a finite future. I discuss these modifications.

The latter part of the paper shows how the residual income valuation model may be used to calculate the implicit expected rate of return on an investment in a firm or a portfolio of firms. The 30 firms in the Dow Jones Industrial Average (DJIA) at December 31, 1998 are used as an example. The rate of return that is implied by the price of these stocks at the close of trading for 1998 and by the analysts' forecasts of earnings at that date is 15.7 percent. Since, *ceteris paribus*, a lower price would imply a higher expected rate of return, proponents of the view that the DJIA was over-valued at that time would have to support an argument that an expected rate of return of greater than 15.7 percent is sustainable in the long-run future.

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2 Derivation of the Dividend Capitalization Model

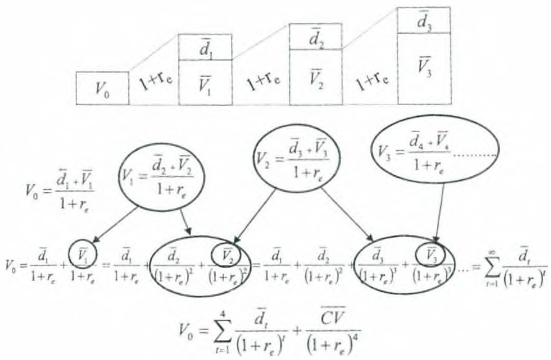

Figure 1: Derivation of the Dividend Capitalization Model

Figure 1 depicts the derivation of the dividend capitalization model. The implicit value of the common shareholder's equity V_0 is expected to grow at a rate of return, r_e, and at the end of the return period the firm is expected to pay a dividend, d_1, so that the implicit value of equity remaining in the firm is $\bar{V}_1$. In turn, the implicit value $\bar{V}_1$ will continue to grow at r_e and after the payment of dividends d_2 at the end of period 2, the remaining implicit value will be $\bar{V}_2$... and so on. That is, the relation between the implicit value of common shareholder's equity at time 0 and implicit value one period later may be expressed as follows:

$$\overline{V}_t = \frac{\overline{d}_{t+1}+\overline{V}_{t+1}}{1+r_e} \text{ or } \overline{V}_t = \frac{\overline{d}_{t+1}}{1+r_e}+\frac{\overline{V}_{t+1}}{1+r_e} \qquad (1)$$

Figure 1 shows how by recursively substituting this formula for future expected value $\overline{V}_{t+1}$, we can derive the relation between implicit value at the beginning of the investment horizon V_0 and the expected future stream of dividends (d_1, d_2, d_3,d_4,...etc), which may extend for an infinite horizon.

As a practical matter, however, we will only make forecasts for a finite future period but in order to value the firm we must estimate the value at the end of this period. We refer to this value as the continuing value. The most general way of expressing this continuing value is to assume that the dividends will grow at a constant rate g_d from the end of the last forecast period (period 4 in Figure 1) so that its continuing value at the forecast horizon is:

$$CV_T = \frac{\overline{d}_{T+1}}{r_e - g_d} \qquad (2)$$

The difficult practical issue becomes forecasting the rate of perpetual growth in dividends g_d and it is for this reason that the dividend capitalization formula is rarely used as a valuation tool.

The dividend capitalization formula is, however, a very useful basis for understanding the derivation of the residual income valuation model. We will use it for this purpose in the next section of the paper.

3 Derivation of the Residual Income Valuation Model

The relation between prices and future expected values that is used in the above derivation of the dividend capitalization formula is generally known as the no-arbitrage assumption. The derivation of the residual income valuation model relies

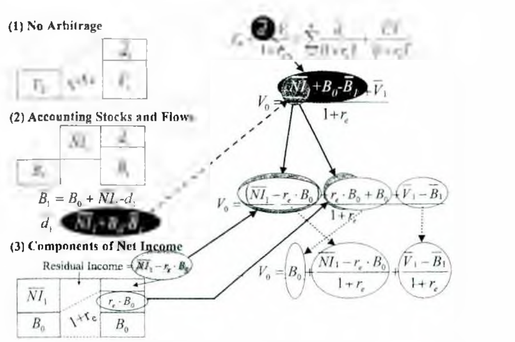

Figure 2: Derivation of the Residual Income Valuation Model: Single Period

on: (1) this assumption, (2) the relation between accounting net income as reported in the income statement and the book value of owner's equity as reported in the balance sheet, and (3) the definition of residual income. The use of these features in the derivation of the residual income valuation model is shown in Figure 2.

First, the *no arbitrage* assumption captures the relation between current values and future dividends. Second, net income, $\overline{NI}_1$ is the accounting measure (that is, the outcome of generally accepted accounting principles) of the value added (lost) during period 1. Book value B_0 is the accounting measure of value at the beginning of the reporting period and if there are no dividends distributed to shareholders, the book value at the end of period 1 will be equal to the sum of beginning book value and net income of the period. However, dividend payments will reduce the ending book value so that in general:

$$\overline{B}_1 = B_0 + \overline{NI}_1 - \overline{d}_1 \qquad (3)$$

This relation which is known as the *accounting stocks and flows equation* may be used to form an expression for dividends $\overline{d}_1$ in terms of net income $\overline{NI}_1$ and change in book value ($\overline{B}_1$-B_0) and this expression is substituted for dividends in the no-arbitrage relation.

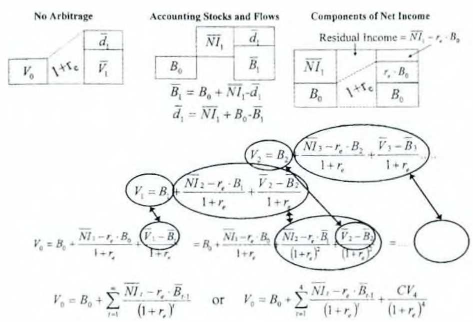

Figure 3: Derivation of the Residual Income Valuation Model: Multi Period

Third, residual income may be defined as the income in excess of a normal (or expected) income from the assets used to generate that income. Book value is the accountants' measure of the value of these assets. Since the expected rate of return is r_e, the normal income from the assets is $r_e \cdot B_0$. The income in excess of this normal income (that is, the residual income) is $\overline{NI}_1$-$r_e \cdot B_0$. In other words, net income may be viewed as having two *components* (1) a normal component $r_e \cdot B_0$ and (2) the remaining portion $\overline{NI}_1$-$r_e \cdot B_0$ (that is, residual income). Figure 2 shows how these two components may be substituted for net income so that current implicit value is expressed in terms of future net income and current and future book value. That is, for any time period t to t+1:

$$V_0 = B_0 + \frac{NI_1 - r_e \cdot B_0}{1 + r_e} + \frac{V_1 - B_1}{1 + r_e} \qquad (4)$$

Figure 3 shows how the residual income valuation model for an infinite investment horizon may be derived by rearranging this formula and recursively substituting for V_1-B_1 in the same way as we substituted recursively for future expected dividends d_t in the derivation of the dividend capitalization formula. Thus, in general, value at time t, V_t, may be expressed in terms of the book value of owner's equity reported in the balance sheet at t (that is, B_t) and the present value of future expected residual income:

$$V_t = B_t + \sum_{\tau=1}^{\infty} \frac{NI_{t+\tau} - r_e \cdot B_{t+\tau-1}}{(1+r_e)^\tau} \qquad (5)$$

As we observed in our discussion of the practical implementation of the dividend capitalization formula, again we only have forecasts of net income for a finite future period and in order to value the firm we must estimate the continuing value at the end of this period. The most general expression for this continuing value assumes that the residual income at the end of the forecast horizon grows at a constant rate g_e from the end of the last forecast period (period 4 in Figure 3) so that its continuing value at the forecast horizon is:

$$CV_T = \frac{NI_{T+1} - r_e \cdot B_T}{r_e - g_e} \qquad (6)$$

and at any point in time t value may be expressed as:

$$V_t = B_t + \sum_{\tau=1}^{T} \frac{NI_{t+\tau} - r_e \cdot B_{t+\tau-1}}{(1+r_e)^\tau} + \frac{NI_{t+T+1} - r_e \cdot B_{t+T}}{(r_e - g_e)(1+r_e)^{T}} \qquad (7)$$

This form of the residual income valuation model is the foundation of several recent market-based accounting research studies. For example, Lee, Myers and Swaminathan [1999] assume a rate of growth in residual income g_e for each of the firms that constitute the Dow Jones Industrial Average (DJIA) and they calculate a firm specific rate of return r_e for each of these firms using the Fama and French [1992] three-factor model.[2] These estimates enable them to determine the value of the DJIA implied by three years of analysts' forecasts of net income (earnings). The method in Lee, et al. [1999] suggests that the price at which this group of stocks was trading at the end of 1998 was approximately 1.6 times the implicit value. This suggests that the DJIA was over-priced at that time. Of course, the estimate of implicit value in Lee, et al. [1999] is dependent on their assumptions about the expected rate of return and the expected rate of growth in residual income.

4 Estimation of Expected Rate of Return and Growth in Residual Income

The remainder of the paper shows how the model may be used to determine the expected rate of return (cost of equity capital) and the expected rate of growth in residual income implied by the price at which the firms trade in the stock market. Details of this analysis are provided in Easton, Taylor, Shroff, and Sougiannis [2000]. I will only highlight the key features in this paper. The most obvious application of the method is the estimation of the internal rate of return from an investment in a portfolio of stocks. However, the method may also be useful in firm valuation. After completing the pro-forma forecasting of earnings (as described in, Penman [2000], for example) and/or after obtaining analysts' forecasts of net income for a number of firms with comparable operating activities, the method may be used to estimate the market's expectation of r and g for these firms. These estimates for comparable firms may be used to determine the implicit value of an unlisted firm, a division of a firm, or a firm that is believed to be relatively over/under-valued.

The key idea of the analysis is most easily seen in the context where we are faced with forecasts of net income for a very short horizon, say, just one future period. I will begin by considering short horizon forecasts and then show how the analysis may be extended to longer horizons. Suppose, for example, that we have forecasts of net income for just two future periods. The residual income valuation formula is:

$$V_t = B_t + \frac{NI_{t+1} - r_e \cdot B_t}{1 + r_e} + \frac{NI_{t+2} - r_e \cdot B_{t+1}}{(r_e - g_e)(1 + r_e)} \qquad (8)$$

and if we have a forecast for just one future period, the residual income valuation formula is:

$$V_t = B_t + \frac{NI_{t+1} - r_e \cdot B_t}{r_e - g_e} \qquad (9)$$

The essence of the analysis in Easton et al. [2000] is determination of the expected rate of return r_e and the rate of growth g_e that are implied by the price P_t at which stocks are trading. That is, P_t

replaces V_t in equation (9). This equation may then be re-expressed as a linear relation between the price-to-book value ratio and the ratio of the forecast of net income-to-book value:

$$\frac{P_t}{B_t} = \frac{g_e}{r_e - g_e} + \left(\frac{1}{r_e - g_e}\right) \cdot \frac{\overline{NI}_{t+1}}{B_t} \qquad (10)$$

That is,

$$\frac{P_t}{B_t} = \alpha_0 + \alpha_1 \cdot \frac{\overline{NI}_{t+1}}{B_t} \qquad (11)$$

The coefficients α_0 and α_1 may be estimated via a simple linear regression and these estimates may be used to derive estimates of the expected rate of return r_e and the growth in residual income g_e. The issue now is… How do we combine forecasts of net income for several future periods so that the linearity is maintained. This combination relies on the idea that accounting net income may be summed (not compounded) over time. The net income for a year is the sum of the net income for each of the four quarters. Similarly, the net income for a four-year period is the sum of the net income for each of the four years. The only complication is that we must take account of the net income that the owners of the shares will receive from the re-investment of the dividends that are expected to be paid over the forecast horizon – that is, net income must be cum-dividend.

Example:

Forecasts for AT&T at end of 1998

	Net Income $\overline{NI}_t$	Dividends d_t	Net Income from Dividends
1999	4.02	1.32	$1.32*(1.12^3-1) = 0.53$
2000	4.73	1.32	$1.32*(1.12^2-1) = 0.34$
2001	5.84	1.32	$1.32*(1.12^1-1) = 0.16$
2002	5.20	1.32	$1.32*(1.12^0-1) = 0.00$
	19.79		= 0.93

Aggregate cum-dividend net income

= \$20.82

Figure 4: Earnings Aggregation

Suppose we have forecasts of net income for the next four years. We can maintain the linearity by letting $\overline{NI}_{t+1}$ be forecasted cum-dividend net income of an entire four-year period. For example, consider the forecasts of earnings and dividends for one of the firms in the Dow Jones Industrial Average – AT&T – at the end of 1998. These forecasts and the calculation of forecasted cum-dividend net earnings are shown in Figure 4. I assume for the sake of the illustration that AT&T has a cost of capital of 12 percent and that dividends are forecast to remain unchanged at \$1.32 per share for the next four years. If the expected rate of return is indeed the opportunity cost of capital, the dividend paid at the end of 1999 may be re-invested over the remaining three years of the investment horizon and the expected net income from that dividend will be \$0.53. Similarly, the expected net income from the expected dividends at the ends of the years 2000 and 2001 will be \$0.34 and \$0.16, respectively. Thus the total net income from dividends is expected to be \$0.93. The sum of the four years of forecasts of net income is \$19.79 so that the total expected cum-dividend net income for the four-year period is \$19.79 + \$0.93 = \$20.82. If we let net income in equation (11) be cum-dividend net income of the four-year forecast horizon, the expected rate of return and the expected rate of growth in residual income must also be determined for the entire four-year-period. In the AT&T example, the four-year expected rate of return will be $(1.12^4 - 1)$.

5 Analysis of the Dow Jones Industrial Index

Table 1 shows the data for the 30 stocks in the Dow-Jones Industrial Average. These data include: the price on December 31, 1998 (that is, P_0), the book value of equity for the fiscal year ending December 31, 1998 (that is, B_0), and the net income forecasts for the years 1999, 2000, 2001 and 2002 announced by I/B/E/S Inc. on December 17, 1998 (that is, $\overline{NI}_1$ $\overline{NI}_2$ $\overline{NI}_3$ and $\overline{NI}_4$). We also show the dividends for the year ending December 31, 1998 and we calculate the four-year aggregate cum-dividend net income for the four-year forecast horizon assuming dividends remain constant over this period. In the last two rows we report the price-to-book ratio (the dependent variable in our regression) and the ratio of aggregate cum-dividend net income-to-book value (the independent variable in our regression). Using the regression procedure spelled out in Easton et al. [2000] we obtain estimates of α_0 and α_1 of - 5.42 and 8.11. From these estimates we obtain estimates of the expected rate of return of 15.7 percent and an expected growth in residual income of 13.6 percent. This rate of growth in residual income corresponds to a rate of growth in earnings of 17.1 percent.

The sensitivity of estimates of intrinsic value to estimates of growth is apparent from equation (7). Since the estimates of growth used in the extant literature (see, for example, Lee et al. [1999]) are considerably lower than the estimate implied by market prices, it is not surprising that the common conclusion is that the market is over-valued.

Analysis of the value of the DJIA rests on the

Table 1

Firm	Price P_0	Book Value B_0	Forecasts of Net Income $\overline{NI}_{11}$	$\overline{NI}_{12}$	$\overline{NI}_{13}$	$\overline{NI}_{14}$	Div d_0	Cum-Div Agg $\overline{NI}$	P0/B0	Cum-Div Agg $\overline{NI}$/B0
AT&T	75.75	14.55	4.02	4.73	5.84	6.20	1.32	20.82	5.20	1.43
Alcoa	74.56	32.72	5.26	6.82	6.60	7.19	1.50	27.07	2.28	0.83
Allied-Signal	44.31	9.48	2.65	3.08	3.50	4.00	0.60	13.74	4.67	1.45
American Express	102.50	21.53	5.40	6.16	7.02	8.00	0.68	27.19	4.76	1.26
Boeing	32.63	13.13	1.78	1.75	2.50	4.20	0.56	11.33	2.48	0.86
Caterpillar	46.00	14.36	3.72	5.27	5.80	6.38	1.10	22.11	3.20	1.54
Chevron	82.94	26.08	3.43	4.15	4.47	4.80	2.44	18.74	3.18	0.72
Citigroup Inc	49.69	17.89	3.50	3.95	4.50	5.13	0.56	17.62	2.78	0.99
Coca Cola	67.00	3.41	1.52	1.74	2.00	2.30	0.60	8.03	19.66	2.36
Disney	25.38	9.36	1.00	1.18	1.53	1.61	0.19	5.41	2.71	0.58
Du Pont	53.06	12.18	3.00	3.48	3.83	4.21	1.37	15.58	4.36	1.28
Eastman Kodak	72.00	12.35	5.20	5.75	6.35	7.02	1.76	25.77	5.83	2.09
Exxon	73.13	18.02	2.90	3.35	4.30	4.60	1.64	16.45	4.06	0.91
General Electric	102.00	11.89	3.20	3.62	4.09	4.62	1.25	16.52	8.58	1.39
General Motors	71.56	22.87	8.90	9.54	10.23	10.96	2.00	41.16	3.13	1.80
Goodyear	50.44	24.02	4.70	5.12	5.59	6.09	1.20	22.42	2.10	0.93
Hewlett Packard	60.25	16.66	3.45	4.10	4.72	5.42	0.60	18.58	3.62	1.12
IBM	184.38	20.95	7.71	8.94	10.03	11.33	0.86	38.97	8.80	1.86
International Paper	44.81	28.99	1.30	2.70	7.50	8.04	1.00	20.34	1.55	0.70
Johnson&Johnson	83.88	10.11	3.03	3.47	3.71	4.19	0.97	15.16	8.30	1.50
McDonalds Corp.	76.81	13.96	2.89	3.24	3.66	4.14	0.35	14.17	5.50	1.02
Merck & Company	147.50	10.85	5.00	5.64	6.01	6.63	1.98	25.04	13.60	2.31
Minnesota Mining & Man.	71.13	14.77	4.25	4.40	4.86	5.37	2.20	20.56	4.82	0.39
Morgan J.P.	105.06	60.38	6.70	7.37	8.11	8.92	3.84	34.05	1.74	0.56
Philip Morris Companies	53.50	6.66	3.40	3.80	4.31	4.90	1.68	17.75	8.03	2.66
Proctor & Gamble	91.06	9.00	3.11	3.69	4.17	4.71	1.01	16.51	10.12	1.84
Sears Roebuck & Co.	42.50	15.82	3.75	4.23	4.77	5.38	0.92	18.83	2.69	1.19
Union Carbide	42.50	18.46	2.00	2.76	3.01	3.28	0.90	11.77	2.30	0.64
United Technologies	108.75	19.45	5.70	6.50	7.18	8.10	1.39	28.66	5.60	1.47
Wal-Mart Stores	86.00	9.49	1.74	1.97	2.22	2.51	0.31	8.76	9.06	0.92

Notes to Table 1
P_0 is price per share,
B_0 is book value of equity per share,
$\overline{NI}_1$, $\overline{NI}_2$, $\overline{NI}_3$, and $\overline{NI}_4$ are, respectively, the forecasts of earnings per share for years 1999, 2000, 2001 and 2002,
d_0 is the 1998 dividends per share,
Cum-Div Agg $\overline{NI}$ is the aggregate forecasted cum-dividend earnings per share assuming an expected rate of return of 12%,
P_0/B_0 is the price-to-book ratio,
Cum-Div Agg $\overline{NI}/B_0$ is the ratio of aggregated cum-dividend forecasted income-to-book.

answer to the following question. Is an expected rate of return of 15.7 percent reasonable? If so, the DJIA was not over-valued at December 31, 1998. The arguments that the price of the DJIA was too high would need to include reasons why an expected rate of return of 15.7 percent is too low because, *ceteris paribus*, the lower the price the higher the expected return. In other words, if the implicit value of the DJIA is less than the price at which stocks comprising the Index trade, the expected rate of return associated with this lower price would be higher.

Providing unequivocal evidence regarding the reasonableness of 15.7 percent is difficult, perhaps impossible, but the following data may be helpful. The average annual return over the entire history of the DJIA (1896 to 1998) is 7.9 percent. Over the period during which there have been thirty stocks in the DJIA (1928 to 1998) the average annual return has been 7 percent. These lower rates would suggest that the DJIA is not overpriced. More recent returns have been much higher than these historical averages. For example, the average annual return from 1981 to 1998 was 15.4 percent – slightly less than the market's expectation of 15.7 percent as at December 31, 1998. Finally, we note that the realized returns on the DJIA have been considerably higher than 15.7

percent in each of the years 1995 to 1999 (33.5%, 26.0%, 22.64%, 16.1% and 25.2%, respectively). These more recent rates of return may, indeed, suggest that the market's expectation of a 15.7 percent rate of return was too low – however, the question of the sustainability of these higher rates remains.

6 Concluding Remarks

The expected rate of return that we have calculated is the internal rate of return from an investment in the Dow Jones Industrial Average implied by the analysts' forecasts of net income. The calculation of this rate of return is analogous to the calculation of the (internal) rate of return on a bond that may be obtained from the price of the bond and the coupon payments. The critical difference is that we must adjust for the fact that the forecasts of net income are based on generally accepted accounting principles and thus the finite horizon forecasts will not capture the entire future value (as they do in valuation of a bond). The residual income valuation model, outlined in this paper, achieves this adjustment via the estimate of growth in residual income beyond the forecast horizon. The estimates of expected return on shares obtained in this way may be used to choose among investment alternatives in the same way as estimates of internal rates of return have been used to evaluate investments in debt securities and other assets.

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NOTES

1 This paper is based on a presentation at the *Maandblad voor Accountancy en Bedrijfseconomie* conference on 'Accounting Information, Firm Valuation and Firm Value Management' held at the University of Amsterdam on November 19, 1999.

2 Lee, et al. [1999] make two assumptions regarding growth in residual income. Either the growth beyond the forecast horizon is zero or it is the rate implied by allowing the firm's return-on-equity to fade to the industry median over a finite time.